

Nalco Docket No. 7774  
Customer No. 49459

### REMARKS

Claims 1, 2, 8, 10, 11, 32, and 33 are pending in this Application. Claims 12 to 29 stand withdrawn. The Office Action objected to Claim 8 under 35 U.S.C. 1.75(c); rejected Claims 1, 2, 8, 10, 11, 32, and 33 under U.S.C. § 112, second paragraph; and rejected Claims 1, 2, 8, 10, 11, 32, and 33 under 35 U.S.C. §§ 102(a) and/or (b).

Claims 1, 2, and 8 have been amended. No new matter has been added.

The Office Action requested that Applicants clarify interpretation of the claims with regard to characterization of the "metal-silicate lattice microstructure." (Office Action at page 3, paragraph 3).

In addition to the Declaration of Brian T. Holland at paragraph 10 (enclosed herewith), Applicants direct attention to the Specification at page 8, line 27 to page 9, line 23:

In an embodiment, the resultant silica colloid is capable of supporting from about 0.0001wt% to about 35wt% metal based on silica. The metal-stabilized silica solid phase also demonstrates increased stability and remains stable in a pH range of about 1 to about 14. The skilled artisan will appreciate that "stable" means that the solid phase of the colloid is present, dispersed through the medium and stable throughout this entire pH range with effectively no precipitate. The solid phase in an embodiment is amorphous and has a number of particles that are generally spherical in shape. The colloidal particles have a diameter in the range of about 2 nanometers (nm) to about 1000 nm pursuant to an embodiment.

In another embodiment of the present invention, silicic acid is utilized to incorporate or disperse a metal component into the framework of colloidal silica (i.e., doping). The method includes preparing a heel. The heel includes an aqueous solution that at least includes a quaternary amine as defined herein or an alkaline agent. Suitable alkaline agents include, for example, NaOH, KOH, NH<sub>4</sub>OH, the like and combination thereof. The silicic acid solution (can be prepared as previously discussed or other suitable manner) is reacted with a cationic metal component to form a metal silicate solution, represented chemically below:



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The metal silicate solution is subsequently added to the heel to form the colloid. During particle formation, the OH<sup>-</sup> present in the heel catalyzes the copolymerization of the cationic metal component and silicate (SiO<sub>4</sub><sup>-</sup>) from the silicic acid. This produces a colloid with the metal dispersed within the silicate (i.e., incorporated into the particle framework as discussed above), such as having a homogenous distribution of the metal component throughout the entire solid phase of the colloid. Not wishing to be bound by any particular theory, it is believed that the dispersion and loading of the metal is obtained as the copolymerization forms a metal-silicate lattice throughout the microstructure of the solid phase.

Thus, in at least the referenced section the Specification describes the metal-silicate lattice as having metal dispersed and incorporated into the particle framework. Applicants have amended Claim 1 to clarify this element.

#### CLAIM OBJECTIONS

The Office Action objected to Claim 8 under 37 C.F.R. 1.75(c), as being of improper dependent form for failing to further limit the subject matter of the previous claim. Applicants have amended Claim 8 to address this rejection. Accordingly, Applicants respectfully request that this objection be withdrawn.

#### CLAIM REJECTIONS UNDER 35 U.S.C. § 112, SECOND PARAGRAPH

The Office Action rejected Claims 1, 2, 8, 10, 11, 32, and 33 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention.

The Office Action states, "it is unclear whether Applicants intend the lattice structure to define the microscopic arrangement between silica and metal cations in both amorphous and crystalline materials or that said materials are exclusive to crystalline materials."

Applicants have amended Claims 1 (and Claims 2, 8, 10, 11, 32, and 33 by dependency) to clarify the metal-silicate lattice exists in both amorphous and generally spherical colloidal

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particles and crystalline materials. Accordingly, Applicants respectfully submit that this rejection has been overcome and respectfully request that this rejection be withdrawn.

CLAIM REJECTIONS UNDER 35 U.S.C. §§ 102(a) and (b)

The Office Action rejected Claims 1 and 2 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 5,597,512 to Watanabe et al. ("Watanabe").

In support of this rejection, the Office Action states:

Watanabe (examples and claims, particularly claims 4 and 5) disclose making silica sols having 972 ppm and 1156 ppm of CaO. Watanabe (examples and claims) disclose the use of sodium hydroxide as a stabilizer as well as quaternary ammonium compounds (claims 4 and 5) as stabilizers. Watanabe (claims) disclose the use of MgO or CaO in the form of metal salts with silicic acid. Watanabe discloses the use of the sols as surface coating agents. The claimed lattice structure would be inherent to Watanabe materials as the microstructure of the particles based on the divalent and tetravalent arrangement of the alkaline earth metal cations with the siloxy structure formed from the silicic acids.

Office Action at pages 4 to 5, paragraph 7.

Applicants respectfully disagree with and traverse this rejection for at least the following reasons.

As noted in the Office Action, Watanabe discloses the use of MgO and CaO in the form of silica salts with silicic acid. Applicants respectfully assert, however, "it is well known in the art that the interaction of magnesium and calcium ions with silicic acid is negligible. This type of interaction indicates that these cations are only in solution and do not interact with the silica. Watanabe indicates the presence of alkaline earth cations, added based on CaO and MgO, but it is actually the cation in solution and as a result is not part of the silica framework." (Brian T. Holland declaration, at paragraph 7).

Watanabe thus fails to disclose a synthetic metal-containing colloidal silicate composition as in Amended Claim 1. In particular, Watanabe fails to disclose a metal covalently copolymerized and incorporated into a metal-silicate lattice solid phase having colloidal particles.

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Therefore, Applicants respectfully submit that Amended Claim 1 (and Claim 2 that depends therefrom) is patentably distinct over Wattanabe and in condition for allowance. Applicants accordingly respectfully request that this rejection be withdrawn.

The Office Action also rejected Claims 1, 2, 8, 10, 32, and 33 under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,287,086 to Finlayson et al. ("Finlayson").

In support of this rejection, the Office Action states:

Finlayson discloses organic systems employing organophilic clay suspended in said organic systems. The organophilic clay is made organophilic by addition of a quaternary amine. Said clay is inherently a layered material that is in colloidal form. Bentonite and hectorite are both montmorillonite clays. Hectorite is known to be a sodium/magnesium/lithium silicate. Bentonite is known as an aluminosilicate and would have been expected to be inherently spherical since the said materials have not been otherwise stated.

Office Action at page 5, paragraph 8.

Applicants respectfully disagree with and traverse this rejection for at least the reasons below.

Finlayson discloses, "An organophilic clay, which is the reaction product of a smectite clay having a cation exchange capacity of at least 0.75 milliequivalents per gram." (col. 2, lines 44 to 46. Further, as stated in the Declaration of Brian T. Holland, "In terms of the clay versus colloidal silica with quaternary amines, the materials are completely different. A clay is a layered material with the quaternary amine as the cation, similar to the calcium ions shown [in paragraph 7]. [In paragraph 9] is an example showing the layered material with the quaternary amine as the counter ion. Such clay particles have  $N^+-R_4$ , ( $R_4=H, CH_3$ , etc) as counter ion. Again, not part of the material." (paragraph 9).

Thus, Finlayson fails to disclose a synthetic metal-containing colloidal silicate composition as in Amended Claim 1. In particular, Finlayson fails to disclose a metal covalently copolymerized and incorporated into a metal-silicate lattice solid phase having colloidal particles.

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Therefore, Applicants respectfully assert that Amended Claim 1, and Amended Claims 2 and 8, and Claims 10, 32, and 33 that depend therefrom, are patentably distinct from Finlayson and in condition for allowance. Applicants respectfully request that this rejection accordingly be withdrawn.

The Office Action further rejected Claims 1, 2, 8, 10, 11, 32, and 33 under 35 U.S.C. § 102(b) as being anticipated by Mintova and Valtchev, "Effect of silica source on the formation of nanosized silicalite-1: an in situ dynamic light scattering study," Microporous and Mesoporous Materials, 55 (2002): 171 to 179 ("Mintova").

To support this rejection, the Office Action states:

Mintova (2. Experimental) discloses the synthesis of nanosized silicalite-1 comprising 9 moles tetrapropylammonium hydroxide (TPAOH) : 0.13 moles  $\text{Na}_2\text{O}$  : 25 moles  $\text{SiO}_2$  in water and ethanol. The hydrothermal treatment results in the crystallized layered structure and the alkali metal, i.e., sodium is present in less than 2 wt% of silica. The materials would have been expected to be inherently spherical since the said materials have not been otherwise stated.

Office Action at page 5, paragraph 9.

Applicants respectfully disagree with and traverse this rejection for at least the reasons below.

Mintova fails to disclose a synthetic metal-containing colloidal silicate composition as in Amended Claim 1. Mintova discloses neither a metal-silicate lattice solid phase having colloidal particles nor a metal covalently copolymerized and incorporated into the lattice within the colloidal particles. Rather, Mintova discloses methods of forming silicalite-1 nanocrystals, which are well known to be void of covalently attached (i.e., non ion exchangeable) metal.

Therefore, Applicants respectfully assert that Amended Claim 1, and Amended Claims 2 and 8 and Claims 10, 11, 32, and 33 that depend therefrom, are patentably distinct from Mintova and in condition for allowance. Applicants respectfully request that this rejection be withdrawn.

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The Office Action rejected Claims 1, 2, 8, 10, 11, 32, and 33 under 35 U.S.C. § 102(a) as being anticipated by Cundy et al., "Some observations on the preparation and properties of colloidal silicates. Part I: synthesis of colloidal silicalite-1 and titanosilicalite-1 (TS-1)," Microporous and Mesoporous Materials, 66 (2003): 143 to 156 ("Cundy").

The Office Action states the following in support of this rejection:

Cundy (page 146, 2.2 Preparation of TS-1 sols) discloses the preparation of titanosilicalite-1 sols with TPAOH having 6 mole % of titanium metal and discloses as little as 1 mole % titanium metal. The 1 mole % equates to less than 2 wt% of metal based on silica. The materials would have been expected to be inherently spherical since the said materials have not otherwise been stated.

Office Action at page 6, paragraph 10.

Applicants respectfully disagree with and traverse this rejection for at least the following reasons.

Cundy fails to disclose a synthetic metal-containing colloidal silicate composition including a metal-silicate lattice solid phase with metal covalently copolymerized and incorporated within colloidal particles of the solid phase. On the contrary, Cundy merely uses structure directors to synthesize zeolite crystals. It is well known in the art that the Cundy silicalite-1 product is void of such covalently copolymerized and incorporated metal.

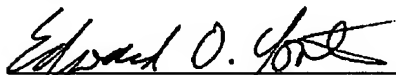
Therefore, Applicants respectfully assert that Amended Claim 1, and Amended Claims 2 and 8 and Claims 10, 11, 32, and 33 by dependency, are patentably distinct over Cundy and are in condition for allowance. Applicants respectfully request that this rejection be withdrawn.

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### CONCLUSION

In view of the foregoing amendment and remarks, Applicants respectfully request withdrawal of the objection under 37 C.F.R. 1.75(c) and the rejections under 35 U.S.C. § 112, second paragraph, and 35 U.S.C. §§ 102(a) and 102(b). Applicants respectfully assert that all pending claims in this Application are in condition for allowance and earnestly solicit early notice to this effect.

Respectfully Submitted,



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